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ON THE APPROPRIATENESS OF APPROPRIATE JUDGEMENTS IN DESIGN EVALUATION

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ABSTRACT

This paper discusses issues related to the knowledge universities can disseminate to commercial organizations in enterprise-driven ventures. It focuses on the area of automotive design. This industry is challenged with designing small, yet desirable and beautiful vehicles. In response, we present the findings of an empirical study which aimed to evaluate if, and to what extent, previously identified automotive design principles were related to vehicle aesthetics. Automotive design experts were asked to rate a set of vehicles. Research suggests that such “appropriate judges”—as defined by shared knowledge and experience—should have a considerable degree of consensus of opinion with regards to aesthetics. However, this study demonstrated that between experts, large differences existed with regards to their aesthetic appraisal and underlying design principles. These findings are at odds with the suggestion that experts should be able to reach a high level of consensus provided the “judges” share a common education and experience in the relevant domain. This paper puts forward possible explanations for these findings: (1) a lack of agreement in terms of the meaning of commonly used descriptive terms in automotive design; (2) existing descriptive principles may not fully account for differences in appreciation of automotive aesthetics; (3) philosophical issues related to ‘essentialising’ terminology which characterizes human experience. We conclude by suggesting that through conducting design research, academics may be able to challenge preconceived notions in design. This ability may in turn fuel design innovation and thus may be very valuable in enterprise ventures between universities and commercial organizations.

Keywords: Aesthetics, Automotive Design, Expertise, Enterprise-driven research, User Experience

1 INTRODUCTION

In the current climate, universities are increasingly expected to engage with commercial organizations in enterprise-driven ventures. This paper focuses on how design research may inform the automotive design industry with regards notions of perceived beauty. It is argued that trends in automotive technology will see vehicles becoming smaller and lighter making them more conducive to electric drive [1]. Predicated on the assumption that, over time, electric vehicles will be similar in terms of their technical attributes, quality and price, customer enthusiasm and uptake will to a large extent be determined by their visual appearance [2] [3]. This poses an interesting challenge in that larger vehicles are seen as being more desirable and beautiful [4]. In other words, how do we design small, yet desirable and beautiful vehicles? Clough [4] examined our understanding of automotive beauty using a range of methods including surveys, interviews with experts, and visual analyses. From this, Clough [4] created a design framework which included 8 key aesthetic design principles regarded to be of importance in the design of beautiful small cars. According to this framework, the design—with regard to exterior styling—should be *simple, elegant, well-proportioned, flowing, sculptural, minimalistic, fluid, and understated* [4].

This paper reflects on the findings of an empirical study. The aim of this study was twofold. First, it set out to empirically evaluate if, and to what extent, the above automotive design principles were related to vehicle aesthetics. In order to conduct this evaluation automotive design experts were asked to rate images of small urban vehicles in terms of their aesthetics as well as the extent to which they had incorporated each of the design principles. Secondly, the level of agreement between experts was

investigated with respect to the judgment of aesthetics and the proposed design principles. In the field of art, findings of large inter-subject variability in judgments of aesthetics have given rise to the relativistic idea that there are no universal standards [5]. However, it has also been suggested that considerably higher levels of agreement can be reached provided observers share common characteristics [6]. According to Amabile [7] “appropriate judges” (i.e. those familiar with the domain in which the product was created) are able to make objective evaluations. Given their shared characteristics, we expected to observe high levels of agreement not only with respect to the evaluation of vehicle aesthetics, but also with regards Clough’s [4] design principles. The design principles were expected to lead to high levels of agreement among this group of experts based on the fact that the principles emerged from interviews and surveys with car design experts, arguably reflecting a common design language and understanding of automotive beauty. In reflecting on these results, this paper discusses the value of academic research in challenging the universality of design principles. This in turn may provide an opportunity for academics to engage in enterprise-driven collaboration with automotive design professionals in order to aid them reflect on the design process and notions of aesthetics in design.

2 METHOD

2.1 Participants

In this study we exploited the availability of an extremely homogenous group of experts with respect to art-and design-related education and experience. These factors have been shown to be strongly related to aesthetic preferences [6]. A total of eight experts participated in this study. All participants were male with a mean (SD) age of 46 (7.7) years. The “appropriate judges” in this study consisted of UK based educators in automotive design, all of whom previously worked as professional car designers for a minimum of 3 years.

2.2 Stimuli

The stimulus set consisted of 14 compact urban vehicles (see table 1). Compact urban vehicles were chosen to control, at least to some extent, for difference in vehicle type and size and focus on the aesthetic differences within this specific category. Within this vehicle class, a wide selection of typical and novel designs was included. For each vehicle design a three-quarter perspective was shown in greyscale to control for any possible colour effects on aesthetic appreciation.

2.3 Procedure

Each vehicle was presented to participants on a 23 inch monitor for 10 seconds. Following the presentation of each vehicle, participants were asked to rate to what extent they agreed with the statement that “visually, this is a beautiful object” on a Likert scale ranging from 1 (fully disagree) to 7 (fully agree). Participants were then asked to evaluate and rate each of the 12 vehicle designs according to the aforementioned 8 design principles identified to be of particular relevance in the context of automotive aesthetics [4]. Using a 7-point Likert scale (1 = fully disagree; 7 = fully agree), participants were asked to indicate to what extent each vehicle design incorporated these principles.

2.4 Statistical Analysis

The level of agreement was operationalised as the Intraclass Correlation Coefficient (ICC) which is a statistical measure of the consistency with which different “judges” (i.e. design experts) rate a given trait (i.e. aesthetics, simplicity, etc.). The ICC takes on a value between 0 and 1 where the former indicates the absence of any consistency, and a value of one perfect agreement. Returning to the field of art, ICC values for criteria such as simplicity, coherence, and craftsmanship, tend to hover between 0.1 and 0.3 suggesting very low levels of agreement [6]. Given the homogeneity of the expert group in this study, as well as the use of everyday objects (i.e. cars) which show only limited artistic variation when compared to artworks, we hypothesised high levels of agreement within our expert group.

3 RESULTS

3.1 Aesthetic rating

Table 1 shows the minimum, maximum, mean, and Standard Deviation (SD) of the aesthetic ratings for each of the 14 vehicle designs. The designs are presented in order of preference with the most preferred design (Mazda Kiyora) in the top left, the least preferred design (MIT Citycab) in the bottom right. The results show large variations in aesthetic ratings amongst the experts. As judged by the size of the standard deviation, the Lotus City car (SD=1.9), Tata Pixel (SD=1.8), and Mitsubishi MIEV (SD=1.8), showed the lowest level of agreement regarding its aesthetics. The highest level of agreement was observed for the Smart (SD=0.6), and MIT City cab (SD=0.9).

Table 1. Minimum, maximum, mean, and standard deviation (SD) of aesthetic rating for each design from most (top left) to least aesthetically pleasing (bottom right)

Design	Min	Max	Mean	SD	Design	Min	Max	Mean	SD
1. Mazda Kiyora	4	7	5.4	1.1	8. MIEV	1	6	3.5	1.8
2. Tata Pixel	2	7	4.5	1.8	9. Kia Pop	2	6	3.5	1.3
3. Lotus Citycar	2	7	4.4	1.9	10. Citroen Crab	2	6	3.4	1.2
4. Organic	2	6	3.9	1.5	11. Smart	2	4	3.1	0.6
5. Nissan Leaf	1	5	3.6	1.3	12. Suzuki Q	1	5	2.6	1.2
6. Honda commuter	2	5	3.6	1.1	13. iMove	1	4	2.6	1.2
7. Toyota IQ	2	5	3.6	1.1	14. MIT Citycab	1	4	2.0	0.9

3.2. Correlations

Table 2 displays the correlations between all ratings assessed in this study. All 8 design principles showed significant and positive relationships with aesthetics. The highest correlations were observed for “well-proportioned” (.57), “elegant” (.55), and “flowing” (.45). “simple” (.20) and “understated” (.24) showed the lowest correlations with aesthetics. Table 2 further shows that several of the principles showed significant positive correlations with each other suggestive of overlap between the different principles. To further investigate the relationship between the principles, a factor analysis with varimax rotation was performed. The analysis revealed two factors with eigenvalues larger than 1. The factor loadings of the different design principles are shown in table 3.

Table 2. Correlations between mean ratings on scales for experts

	Aesth	Simple	Elegant	Prop	Flow	Sculpt	Minimal	Fluid	Under
Aesthetics	1.00	.20*	.55**	.57**	.45**	.33**	.31**	.31**	.24*
Simple		1.00	.54**	.37**	0.19	0.16	.66**	0.19	.59**
Elegant			1.00	.76**	.56**	.57**	.54**	.54**	.42**
Well-proportioned				1.00	.44**	.45**	.38**	.34**	.34**
Flowing					1.00	.65**	.30**	.88**	.27**
Sculptural						1.00	.37**	.69**	.26*
Minimalist							1.00	.27**	.70**
Fluid								1.00	.27**
Understated									1.00

* p<.05. ** p<.01

3.3 Reliability – Intraclass correlation coefficients

The reliability of judges' ratings was assessed by calculating intraclass correlation coefficients (Ri) for each scale. The intraclass correlation is not the correlation between a predictor variable and the dependent variable but it reflects the extent to which members of the same group tend to act alike. It is the proportion of the total variability in the measured factor that is due to the variability between individuals. Since all observers independently judged the same set of designs, Ri (ICC (3,1) – also known as ICC (CONSISTENCY) – was considered most appropriate [13]. For each of the ratings, the intraclass correlations are presented in Figure 1.

Table 2. Factor loadings of the 8 design principles

Design principle	Component	
	1	2
Simple	.060	.864
Elegant	.633	.583
Well-proportioned	.529	.476
Flowing	.908	.112
Sculptural	.831	.166
Minimalist	.200	.855
Fluid	.908	.082
Understated	.138	.817

Factor loadings greater than .50 are printed in bold

The intraclass correlations showed that the interrater reliability for aesthetics was low indicating little agreement amongst the experts. Regarding the 8 design principles, the least agreement was observed for the principles “understated”, “sculptural”, and “minimalistic”. In contrast, “fluid”, “flowing”, and “simple”, showed the highest level of agreement among the experts.

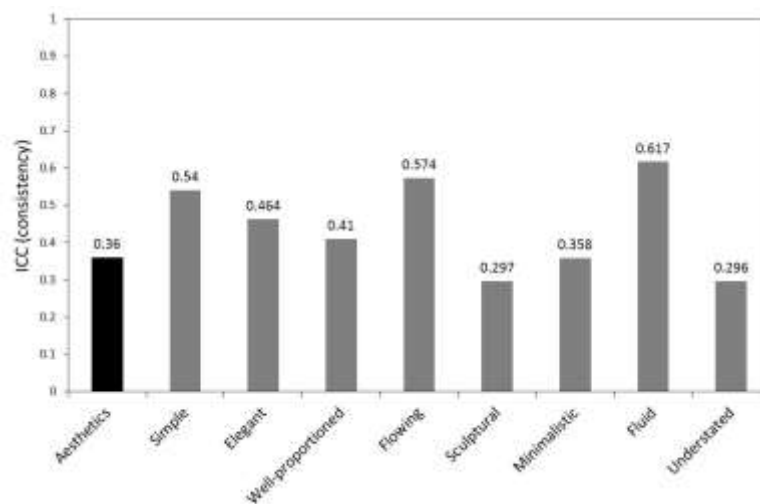


Figure 1. Intraclass Correlation Coefficients (ICC) for aesthetic ratings and the 8 design principles

4 DISCUSSION

The aim of this study was twofold: the empirical validation of (1) the role of several automotive design principles in the perception of aesthetics, and (2) investigation into the level of agreement between experts with respect to the judgment of aesthetics and proposed design principles. The results of the correlational analysis showed that the design principles identified by Clough [4] were significantly related to aesthetics and indicate that automotive beauty is indeed associated with these principles. “well-proportioned”, “elegant”, and “flowing” were shown to be particularly strongly associated with an individual’s perception of automotive aesthetics. However, the results also demonstrated that between experts, large differences existed with regards to both their appraisal of the vehicles’ aesthetic and the extent to which the designs incorporated each of the different principles. These findings appear to be at odds with Amabile’s [7] aforementioned suggestion that experts should be able to reach a high level of consensus provided such “judges” share a common education and experience in the relevant domain. Unlike aesthetic qualities, design principles are less ambiguous and idiosyncratic due to their close association with physical object characteristics. Therefore, it is perhaps even more difficult to understand the lack of agreement with reference to the design principles. In this context, it is also important to realise that the principles were derived from a large body of domain knowledge existing of published automotive literature, surveys, focus groups and interviews involving automotive design experts. As such, the principles at first instance appear to have high face validity. Phrases such as “rolling sculpture” [8], “Fluid rooflines” [9], and “Perfectly Proportioned” [10] also allude to the relevance and ubiquity of these terms in automotive design. Thus, despite the ubiquity of these automotive design terms, there appears to exist little agreement as to what these terms mean.

This surprising notion may provide an opportunity for academics to engage in enterprise-driven collaboration with automotive design professionals in order to aid them reflect on the design process and ideas of aesthetics in design.

The study showed that many of the principles are highly correlated with each other (see table 2) suggesting that the principles may be tapping into the same underlying construct. This was confirmed by the factor analysis indicating the existence of two components or underlying constructs. The first component included “elegant”, “well-proportioned”, “flowing”, “sculptural”, and “fluid”, whereas the second component consisted of “simple”, “elegant”, “minimalist”, and “understated”. Subsequently, we hypothesise that the second component may reflect the more fundamental principle of “unity in variety”. According to this principle, humans prefer objects that have as much complexity or variety as possible with a maximum of unity or order [5]. Similarly, the first component appears to be related to the Gestalt principle of “good continuation” which states that the aesthetic experience of objects is improved by arranging its elements along common lines. Future research is required to explore these underlying constructs further in the context of automotive design but the results would suggest that the list of principles identified by [4] may be too limited to account for the appreciation of automotive aesthetics. This provides a further opportunity for academics to engage in enterprise-driven collaboration with automotive designers.

This paper has discussed whether we can identify design principles underlying automotive aesthetics. In utilising language to describe design principles, one assumes that language is capable of describing certain *essentials* of product form. For Huetwell [11], the notion of essentialism necessitates that the existence of “underlying reality or true nature [...] that gives an object its identity”. Consequently, “‘categories (such as ‘boy’, ‘girl,’ [...]) are real, in several senses: they are discovered (rather than invented), they are natural (rather than artificial), they predict other properties...” [11].

With the above in mind, it can be argued that Clough’s [4] research assumes that Huetwell’s [11] examples of ‘boy’ and ‘girl’ may be replaced with terms such as ‘simplicity’ or ‘elegance’. Through conducting statistical analysis, this paper has argued that Clough’s [4] 8 essential terms can be further reduced (essentialised) to 2 terms, namely ‘good continuation’ and ‘unity in variety’. Through discussing how humans may experience design, it is possible to critique this process of essentialism. Olivier and Wallace [12] argue that reducing individuals’ experiences of design to a set of immutable data can diminish the value of human heterogeneity. Being edicts, design principles are a form of ‘immutable data’ for they attempt to describe—in the words of Huetwell [11] —“an underlying reality or true nature [...] that gives an object its identity”. Following Olivier and Wallace’s [12] argument, we suggest that design principles insufficiently describe the study participants’ experiences of the designs presented to them in the primary research. Philosophical debate regarding the nature of human experience may provide a further opportunity for academics to engage in enterprise-driven collaboration with automotive design professionals in order to aid them reflect on important drivers which influence the sales of vehicles. Research on the nature of experience is particularly important to the automotive industry because of the notion manufacturers must adhere to the tenets of the ‘experience economy’ [14] to increase profit margins.

5 CONCLUSION

Research suggests that “appropriate judges”, as defined by shared knowledge and experience, should have a considerable degree of consensus of opinion with regards to aesthetics in art and design. This paper has reflected on the results of a primary study in which expert judges in the field of automotive design exhibit great disagreement with regards to not only aesthetics but also design principles associated with aesthetic design. This paper has highlighted three issues which may have contributed to these findings. Firstly, we suggested a lack of agreement in terms of the meaning of commonly used descriptive terms in automotive design. Secondly, we argued that existing descriptive principles may not fully account for differences in appreciation of automotive aesthetics. Finally, we referred to philosophical issues related to ‘essentialising’ terminology which characterizes human experience. We suggest that these three issues provide avenues for academics to engage in enterprise-driven engagement with the automotive design industry. Such engagement benefits industry and creates revenue. It also serves as a valuable method to contribute to knowledge in the peer-reviewed academic world through methods of dissemination in conferences and journals. The academic rigor of such avenues help to maintain the intellectual integrity of university-industry enterprise-based endeavors.

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